

# EXHIBIT A

AT THE COURT OF THE  
COMMONWEALTH  
SUPERIOR COURT DEPARTMENT  
CIVIL DOCKET NO. 2181CV00506 H

Commonwealth of Massachusetts

MIDDLESEX, SS.

TRIAL COURT OF THE COMMONWEALTH  
SUPERIOR COURT DEPARTMENT  
CIVIL DOCKET NO. 2181CV00506 H

DAVID ARNOLD, PLAINTIFF(S),

v.

MICHAEL PEARLMAN, DEFENDANT(S)



SUMMONS

THIS SUMMONS IS DIRECTED TO MICHAEL PEARLMAN. (Defendant's name)

**You are being sued.** The Plaintiff(s) named above has started a lawsuit against you. A copy of the Plaintiff's Complaint filed against you is attached to this summons and the original complaint has been filed in the MIDDLESEX SUPERIOR Court. **YOU MUST ACT PROMPTLY TO PROTECT YOUR RIGHTS.**

1. **You must respond to this lawsuit in writing within 20 days.** If you do not respond, the court may decide the case against you and award the Plaintiff everything asked for in the complaint. You will also lose the opportunity to tell your side of the story. You must respond to this lawsuit in writing even if you expect to resolve this matter with the Plaintiff. **If you need more time to respond, you may request an extension of time in writing from the Court.**

2. **How to Respond.** To respond to this lawsuit, you must file a written response with the court and mail a copy to the Plaintiff's Attorney (or the Plaintiff, if unrepresented). You can do this by:

- a. Filing your **signed original** response with the Clerk's Office for Civil Business, MIDDLESEX SUPERIOR Court, 200 TRADE CENTER 2ND, FL. WOBURN, MA 01801 (address), by mail or in person, **AND**
- b. Delivering or mailing a **copy** of your response to the Plaintiff's Attorney/Plaintiff at the following address: DAVID ARNOLD, 94 PIERCE RD, WATERTOWN, MA 02472

3. **What to include in your response.** An "Answer" is one type of response to a Complaint. Your Answer must state whether you agree or disagree with the fact(s) alleged in each paragraph of the Complaint. Some defenses, called affirmative defenses, must be stated in your Answer or you may lose your right to use them in court. If you have any claims against the Plaintiff (referred to as **counterclaims**) that are based on the same facts or transaction described in the Complaint, then you must include those claims in your Answer. Otherwise, you may lose your right to sue the Plaintiff about anything related to this lawsuit. If you want to have your case heard by a jury, you must **specifically** request a jury trial in your Answer or in a written demand for a jury trial that you must send to the other side and file with the court no more than 10 days after sending your Answer. You can also respond to a Complaint by filing a "Motion to Dismiss," if you believe that the complaint is legally invalid or legally insufficient. A Motion to Dismiss must be based on one of the legal deficiencies or reasons listed under **Mass. R. Civ. P. 12**. If you are filing a Motion to Dismiss, you must also comply with the filing procedures for "Civil Motions" described in the rules of the Court in which the complaint was filed, available at www.mass.gov/courts/case-legal-res/rules of court.

4. **Legal Assistance.** You may wish to get legal help from a lawyer. If you cannot get legal help, some basic information for people who represent themselves is available at [www.mass.gov/courts/selfhelp](http://www.mass.gov/courts/selfhelp).
5. **Required information on all filings:** The "civil docket number" appearing at the top of this notice is the case number assigned to this case and must appear on the front of your Answer or Motion to Dismiss. You should refer to yourself as the "Defendant."

Witness Hon. Judith Fabricant, Chief Justice on \_\_\_\_\_, 20 \_\_\_\_.

  
\_\_\_\_\_  
Michael A. Sullivan  
Clerk-Magistrate

Note: The number assigned to the Complaint by the Clerk-Magistrate at the beginning of the lawsuit should be indicated on the summons before it is served on the Defendant.

### PROOF OF SERVICE OF PROCESS

I hereby certify that on \_\_\_\_\_, 20 \_\_\_\_, I served a copy of this summons, together with a copy of the complaint in this action, on the defendant named in this summons, in the following manner (See Mass. R. Civ. P. 4(d)(1-5)):

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Dated: \_\_\_\_\_, 20 \_\_\_\_ Signature: \_\_\_\_\_

N.B. TO PROCESS SERVER:

PLEASE ENTER THE DATE THAT YOU MADE SERVICE ON THE DEFENDANT IN THIS BOX - BOTH ON THE ORIGINAL SUMMONS AND ON THE COPY OF THE SUMMONS SERVED ON THE DEFENDANT.

, 20 ____
-----------

**COMMONWEALTH OF MASSACHUSETTS**

Middlesex, ss.

Middlesex Superior Court  
Civil Action No.

\_\_\_\_\_  
DAVID ARNOLD,  
Plaintiff  
v.  
MICHAEL PEARLMAN  
Defendant

)  
)  
)  
)  
)  
)

**COMPLAINT**

(prepared with the assistance of an attorney)

**INTRODUCTION**

The Plaintiff seeks to recover damages for the Defendant's misrepresentation.

**PARTIES**

1. The Plaintiff, David Arnold ("Mr. Arnold") is an individual residing at 94 Pierce Road, Watertown, Massachusetts 02472.
2. The Defendant, Michael Pearlman ("Dr. Pearlman") is an individual residing at 172 Bishop's Forest Drive, Waltham, MA 02452.

**FACTS**

3. Mr. Arnold is a physicist who is widely recognized in his field for the design of retroreflectors for laser tracking of satellites.
4. Dr. Pearlman is also a physicist who holds a Ph.D. in physics, and was Mr. Arnold's supervisor at various times starting around 1970 when Mr. Arnold was an employee at the Smithsonian Astrophysical Observatory ("SAO") in Cambridge.
5. At the request of Dr. Erricos Pavlis, a NASA scientist, Dr. Pearlman hired Mr. Arnold under a contract between Mr. Arnold and SAO to help design the Italian "Lares-2" satellite. Dr. Pavlis, a Co-Investigator for Lares-2, needs this satellite for space geodesy and earth physics research done by NASA. The Italian design team led by Dr. Paolozzi was funded by the Italian Space Agency ("ASI") through a contract with Sapienza University. Lares-2 was offered a free launch on the test flight of the Vega-C rocket built by the European Space Agency (ESA).

6. From the end of March of 2016 through the end of October, 2018, a period of 31 months, Mr. Arnold performed extensive work on the design of the Italian Lares-2 satellite.
7. The work unexpectedly went far beyond the \$12,000/year specified in the contract (the "Agreement") between Mr. Arnold and SAO attached as Exhibit A.
8. Mr. Arnold worked under the supervision of Dr. Paolozzi as authorized by Dr. Pearlman. Dr. Pearlman did not supervise the work. Mr. Arnold prepared reports as requested by Dr. Pearlman. Mr. Arnold did the work assigned to him by Dr. Paolozzi, relying on the statement made by Dr. Pearlman by email, on March 21, 2016, that this work could be included under SAO funding. See Exhibit B.
9. Dr. Pearlman's statement that there would be funding for Mr. Arnold's work under the SAO contract turned out to be false. Mr. Arnold worked full time for 15 months receiving less than minimum wage payment due to the lack of funding.
10. Dr. Pearlman knew there could be no funding for work on Lares-2 at the time he made the statement. Using NASA funding to support the work of the Italian Space Agency (ASI) is not permitted without an agreement between ASI and NASA. Mr. Arnold did not know that at the time. There was no such agreement. ASI and NASA were beneficiaries of the Lares-2 work. ASI, SAO, and NASA did not fund any of Mr. Arnold's work on Lares-2. Sapienza University made a token payment of 5000 Euros to Mr. Arnold. The Italian design team relied on Dr. Pearlman's agreement to pay Mr. Arnold.
11. Initially, Mr. Arnold was hired to work on a satellite design which would allow for about 2 or 3 mm of accuracy in laser satellite tracking of Lares-2. Mr. Arnold proposed a new design that would allow for 1 mm of accuracy. Dr. Paolozzi decided to study the new design. The work Dr. Paolozzi assigned to Mr. Arnold increased such that Mr. Arnold was often working full time. The project was on a very tight schedule to meet the launch date. Mr. Arnold was the only person who understood the new thermal optical design. Mr. Arnold successfully completed the new design within the deadline.
12. The duties and scope of Dr. Pearlman's authority as contract monitor (COTR) are listed in Exhibit C. Section 4m states, "Prepares requests to (i) fund each contract phase, (ii) obtain additional funding, if necessary, for each phase". On Page 3 of Exhibit A, under DELEGATION OF CONTRACTING OFFICER'S TECHNICAL REPRESENTATIVE (COTR), the last sentence states, "The COTR is not authorized to make any commitments or changes that will affect price, quality, quantity, delivery, or any other term or condition of the contract/purchase order". The SAO Contracting Officer never issued a change order to include the Lares-2 work or any additional funding for this task. To the best of Mr. Arnold's knowledge, there was no agreement between SAO and the

Italian team stating the terms and conditions of Mr. Arnold's work and the funding limit of \$12,000/year. Dr. Pearlman did not participate in the decision to change the design, but supported the decision retroactively. The duty of Dr. Pearlman was to obtain funding for the additional work, or inform Dr. Paolozzi that Mr. Arnold would be unable to work on the new design. Mr. Arnold was never instructed to discontinue working. Dr. Paolozzi continued to give Mr. Arnold a heavy load of cases to be analyzed. It usually takes several months to obtain new NASA funding. However, to meet the launch date, the work on the new design needed to continue uninterrupted pending approval of the additional funding. The work of the Italian team was fully funded by ASI.

13. The work on Lares-2 and any additional funding needed to be approved by the funding agency NASA. However, NASA needed a partnership agreement with ASI. Mr. Arnold unexpectedly learned about this restriction on the use of NASA funds after the work was completed. In October, 2018, Mr. Arnold filed a complaint with Dr. Merkowitz, the NASA official who provided the funding, stating that Dr. Pearlman never paid him for the work on Lares-2. In an email dated November 6, 2018, Dr. Merkowitz stated that he could not provide funding because there was no agreement between ASI and NASA. See Exhibit D. Mr. Arnold resigned on November 10, 2018 due to the failure to pay him. The email from Dr. Merkowitz contradicts the claim by Dr. Pearlman that he had special permission to fund the work on Lares-2. In an email dated October 23, 2018, Dr. Pearlman stated "LARES-2 was an Italian satellite, but recognizing the important of the mission to space geodesy, we agreed that you could spend contract money on this mission." See Exhibit E. In an email dated October 19, 2018, Mr. Arnold reminded Dr. Pearlman that he had not been paid for the Lares-2 work. Dr. Pearlman's response was, "Yes – but think of your contribution to science." See Exhibit F. When the contract was due for renewal in November, 2017, Mr. Arnold told Dr. Pearlman that the workload was beyond available funding. His response was "As far as funding goes, I had to fight hard to get what we got." See Exhibit G. This came as a surprise to Mr. Arnold who expected to be paid retroactively once funding could be arranged for the extra work on the new design. The design had to be completed quickly. The only option was to continue working without proper pay and deal with the funding problems later. See Exhibit H.
14. Mr. Arnold sent Dr. Pearlman timely emails and contract reports during 2016, 2017, and 2018 describing the work on the new design. These reports were forwarded to the funding agency NASA. During the 31 month period from 2016 to 2018, Mr. Arnold worked approximately 15 months on the design of Lares-2. The work on other tasks in the contract amounted to at least \$12,000/year. There were no funds remaining to pay for the work on Lares-2. Mr. Arnold's work is detailed in hundreds of emails, technical reports, and other documents that are available on request. Mr. Arnold published his invention in a paper "Thermal-Optical design of a geodetic satellite for one millimeter accuracy" in the May 15, 2020 edition of the peer reviewed journal Advances in Space

Research. The paper is available at:

<https://www.sciencedirect.com/science/article/pii/S0273117720300491?via%3Dihub>

15. Working 40 hours/week for one month (4.33 weeks) Mr. Arnold should have been paid for 173.20 hours at \$50/hour. This amounts to \$8,660/month. Mr. Arnold was paid \$1,000/month. At 173.20 hours/month this is \$5.77 per hour. The minimum wage in Massachusetts is \$12 per hour. Mr. Arnold should have been paid for 15 months at \$8,660 per month. This is \$129,900.00 for the work on Lares-2. The launch of Lares-2 is expected in mid 2021 on the test flight of the Vega-C rocket built by ESA.
16. Lares-2 is the first upgrade to the Lageos series of geodetic satellites since 1976. It will enable a new era in space geodesy (Exhibit I). Dr. Pearlman never disclosed to Mr. Arnold that he had no authority to pay him to work on the design of Lares-2. Dr. Pearlman wanted Mr. Arnold to retroactively consider the work to be a voluntary "contribution to science" (Exhibit F).

#### **COUNT I MISREPRESENTATION AND FRAUD**

17. Dr. Pearlman falsely stated to Mr. Arnold that there would be funding for him to work on the design of the Italian satellite Lares-2. Dr. Pearlman knew that there could not be funding for work on Lares-2 without an agreement between ASI and NASA. Mr. Arnold, believing his work would be paid for, worked for 15 months on Lares-2 as a result.
18. Dr. Pearlman acted outside the scope of his authority for SAO when he told Mr. Arnold that there would be funding for work on the Lares-2 satellite.

WHEREFORE, the Plaintiff demands judgment against the Defendant in the amount of \$129,900.00 plus interest and costs.

Plaintiff demands a trial by jury on all claims so triable.

Respectfully Submitted,



---

David Arnold  
Pro-se  
94 Pierce Road  
Watertown, MA 02472  
david-arnold@earthlink.net  
617-335-4113

# EXHIBIT A

**Purchase Order****Issuing Office**

Smithsonian Institution  
Smithsonian Observatory  
60 Garden Street  
Cambridge MA 02138  
United States

**Dispatch via Print**

Purchase Order	Revision	Date	Page
15-PO-400-0000316869		01/09/2015	1 of 2
Payment Terms	Freight Terms	Ship Via	
Net 30	FOB Destination	See Below	
Buyer	Phone	Currency	
LENDALL, JOSEPH	617/495-7401	USD	

**Vendor:** 0000042987  
David A. Arnold  
94 Pierce Rd  
Watertown MA 02472

**Ship To:** Smithsonian Observatory  
REF PO: 15-PO-400-0000316869  
60 Garden Street  
Cambridge MA 02138  
United States

**Bill To:** Smithsonian Observatory  
60 Garden Street  
Attn: Accounts Payable, M/S-26  
Cambridge MA 02138  
United States

Tax Exempt?Y		Tax Exempt ID:53-0206027		Contract # (IF ANY)				
Ln-Sch	Item/Description	Mfg ID	Qty	UOM	PO Price	Ext Amt	Due Date	
1 - 1	Non-personal, scientific consulting services		1.00	LOT	15,000.00	15,000.00	09/30/2015	
<b>Line Total</b>						<u>15,000.00</u>		

Contractor shall provide non-personal, technical services to the Smithsonian Astrophysical Observatory to analyze retroreflector configurations and options for satellite missions. The work shall be accomplished in accordance with Attachment (B) Statement of Work.

Period of Performance: October 1, 2014 through September 30, 2015 or until funding limit is reached.

**PRICE AND PAYMENTS**

Contractor's services shall be billed at the rate of \$50 per hour for up to 240 hours. An additional amount of \$3000 is estimated for travel for a total NOT-TO-EXCEED amount of \$15,000.00.

Invoices shall be submitted monthly for work performed during the month billed.

**SAO TRAVEL REIMBURSEMENT:**

- Travel expenses associated with the tasks outlined herein may be billed as long as pre-authorized by the SAO COTR.
- The Contractor shall be reimbursed for such travel upon receipt of documentation those expenses were incurred.
- Rail or air transportation shall be by economy class rail or air travel unless economy rates are not available and the Contractor certifies to this fact in vouchers or other documents submitted for reimbursement.
- Lodging and meals shall not exceed the rates established in the Federal Travel Regulation.

**INDEPENDENT CONTRACTOR NOT AN EMPLOYEE:** It is understood that the Contractor is undertaking the work hereunder as an independent contractor, not as an employee of the Smithsonian, and neither Contractor nor Contractor's employees are eligible for Smithsonian benefits, including coverage under FECA (worker compensation) and FTCA (Federal Tort Claims Act), or coverage under any Smithsonian workers compensation, medical, liability, or other insurance policy, or for legal protections afforded to employees under law applicable to employment relationships. Contractor is responsible for paying all taxes, including estimated taxes, incurred as a result of the payments by Smithsonian to Contractor for performance of this work.

**INTELLECTUAL PROPERTY RIGHTS IN WORK PRODUCT:** The Contractor acknowledges that any and all copyrightable work done for the Smithsonian hereunder will be "work for hire" under the U.S. Copyright Law (17 U.S.C.101) and hereby assigns to the Smithsonian all right, title, and interest in all work product created under the contract, including patents, copyrights, and other intellectual property rights. As a result the Smithsonian will retain full ownership of any product or service that the Contractor provides to the Smithsonian.

803-0000-613853-404R50-6100-2514-4210-40613853RR5000-DEFAULT

**Authorized Signature**

LENDALL, JOSEPH, Procurement Officer

Digitally signed by Joseph Lendall  
DN: cn=Joseph Lendall, o=Smithsonian Institution,  
ou=Smithsonian Astrophysical Observatory,  
email=jendall@ch.harvard.edu,  
Date: 2015.01.09 16:54:12 -0500

**Purchase Order****Issuing Office**

Smithsonian Institution  
 Smithsonian Observatory  
 60 Garden Street  
 Cambridge MA 02138  
 United States

Dispatch via Print

Purchase Order	Revision	Date	Page
15-PO-400-0000316869		01/09/2015	2 of 2
Payment Terms	Freight Terms	Ship Via	
Net 30	FOB Destination	See Below	
Buyer	Phone	Currency	
LENDALL, JOSEPH	617/495-7401	USD	

Vendor: 0000042987  
 David A. Arnold  
 94 Pierce Rd  
 Watertown MA 02472

Ship To: Smithsonian Observatory  
 REF PO: 15-PO-400-0000316869  
 60 Garden Street  
 Cambridge MA 02138  
 United States

Bill To: Smithsonian Observatory  
 60 Garden Street  
 Attn: Accounts Payable, M/S-26  
 Cambridge MA 02138  
 United States

Tax Exempt?Y	Tax Exempt ID:53-0208027	Contract # (IF ANY)	Ln-Sch	Item/Description	Mfg ID	Qty	UOM	PO Price	Ext Amt	Due Date
--------------	--------------------------	---------------------	--------	------------------	--------	-----	-----	----------	---------	----------

INDEMNIFICATION: The Contractor shall defend, hold harmless, and indemnify Smithsonian, its Regents, directors, officers, employees, volunteers, licensees, representatives and agents, and the Government of the United States, against any and all claims, loss and expense (including attorney's fees and litigation expenses), from loss or liability or injury to any persons (including employees or agents of the Contractor or his subcontractors) and from loss of or damage to any property (including property owned by the Smithsonian) arising out of any act or omission of the Contractor, his employees, agents, or subcontractors in the performance of this contract.

DELEGATION OF CONTRACTING OFFICER'S TECHNICAL REPRESENTATIVE (COTR):  
 Michael Pearlman is delegated as the Contracting Officer's Technical Representative (COTR). The COTR shall act for and on behalf of the SAO Contracting Officer in the Administration of this Contract/Purchase Order with respect to: (a) resolving issues that may arise under the Contract as to matters of acceptability or workmanship and other technical requirements; and (b) approving and accepting work performed under this contract. The COTR is not authorized to make any commitments or changes that will affect price, quality, quantity, delivery, or any other term or condition of the contract/purchase order.

Please furnish the above on the Terms and Conditions specified herein and on Attachment (A) to this Purchase Order. Reference paragraph 2(c) of the Terms and Conditions, INVOICE, where it says "Contract Number", use PO# 316869.

**ACCEPTANCE**

The Contractor hereby accepts the offer represented by the numbered Purchase Order subject to all terms and conditions set forth herein.

David A. Arnold  
 Contractor (signature)

JAN 9, 2015  
 Date

Total PO Amount

15,000.00

PO# 316869

**Statement of work: David A. Arnold – Period of performance 10/1/2014-9/30/2015**

1. Computation of the cross section and range correction of retroreflector arrays tracked by the ILRS such as the new generation of GNSS satellites. Compute an “as-built” transfer function for SARAL using measured dihedral angle offsets.
2. Participate in the design, analysis, and testing of retroreflector arrays for missions that will be tracked by the ILRS. Study parameters affecting the range accuracy and cross section of an array such as cube corner size, number of cube corners, type of cube corner (coated, uncoated, hollow), array geometry, single or multiple dihedral angle offsets.
3. Participate in planning and analysis of laboratory tests of retroreflectors and retroreflector arrays.
4. Do comparisons of theoretical and experimental range corrections and return pulse shapes and signal strengths for retroreflector arrays.
5. Work with INFL on engineering analysis of retroreflectors.
6. Update computer models as required for analysis of new designs of retroreflectors such as small COTS reflectors. Convert software as required from iBook G4 format to MacBook Pro format.
7. Provide copies of analyses related to laser ranging for the ILRS website [http://ilrs.gsfc.nasa.gov/about/reports/other\\_publications.html](http://ilrs.gsfc.nasa.gov/about/reports/other_publications.html)
8. Participate in conferences and meetings related to laser ranging.
9. Collaborate with other investigators on projects related to laser ranging.
10. Write a report covering the analyses performed.

**Estimated Cost:**

Labor: (240 hours @\$50/hr)	\$12,000
Travel	\$3,000
	-----
Total Estimated Cost	\$15,000

**Purchase Order**

**Issuing Office**  
 Smithsonian Institution  
 Smithsonian Observatory  
 60 Garden Street  
 Cambridge MA 02138  
 United States

**Vendor:** 0000042987  
 David A. Arnold  
 94 Pierce Rd  
 Watertown MA 02472

**CHANGE ORDER**

Dispatch via Print

Purchase Order	Revision	Date	Page
15-PO-400-0000316869	1 - 11/18/2015	01/09/2015	1 of 2
Payment Terms	Freight Terms	Ship Via	
Net 30	FOB Destination	See Below	
Buyer	Phone	Currency	
LENDALL, JOSEPH	617/495-7401	USD	

**Ship To:** Smithsonian Observatory  
 REF PO: 15-PO-400-0000316869  
 60 Garden Street  
 Cambridge MA 02138  
 United States

**Bill To:** Smithsonian Observatory  
 60 Garden Street  
 Attn: Accounts Payable, WS-26  
 Cambridge MA 02138  
 United States

Tax Exempt?Y	Tax Exempt ID:53-0206027	Contract # (IF ANY)				
Ln-Sch	Item/Description	Qty	UOM	PO Price	Ext Amt	Due Date
1 - 1	Non-personal, scientific consulting services	1.00	LOT	30,000.00	30,000.00	09/30/2016
<b>Line Total</b>					<b>30,000.00</b>	

Change Order #1 is issued to extend the period of performance, add hours and add \$15,000.00 in funding for continuation of services. The Purchase Order is changed, as follows:

\*Period of Performance: October 1, 2014 through September 30, 2016 or until funding limit is reached.

**PRICE AND PAYMENTS**

Contractor's services shall be billed at the rate of \$50 per hour for up to 480 hours. An additional amount of \$6,000.00 is estimated for travel for a total NOT-TO-EXCEED amount of \$30,000.00.\*

ALL OTHER TERMS AND CONDITIONS REMAIN THE SAME.

**ACCEPTANCE:** The Contractor hereby accepts the offer represented by the numbered Change Order subject to all terms and conditions set forth herein.

David A. Arnold  
 Contractor (signature)

NOV. 24, 2015  
 Date

Contractor shall provide non-personal, technical services to the Smithsonian Astrophysical Observatory to analyze retroreflector configurations and options for satellite missions. The work shall be accomplished in accordance with Attachment (B) Statement of Work.

Period of Performance: October 1, 2014 through September 30, 2015 or until funding limit is reached.

**PRICE AND PAYMENTS**

Contractor's services shall be billed at the rate of \$50 per hour for up to 240 hours. An additional amount of \$3000 is estimated for travel for a total NOT-TO-EXCEED amount of \$15,000.00.

Invoices shall be submitted monthly for work performed during the month billed.

**SAO TRAVEL REIMBURSEMENT:**

- Travel expenses associated with the tasks outlined herein may be billed as long as pre-authorized by the SAO COTR.
- The Contractor shall be reimbursed for such travel upon receipt of documentation those expenses were incurred.
- Rail or air transportation shall be by economy class rail or air travel unless economy rates are not available and the Contractor certifies to this fact in vouchers or other documents submitted for

803-0000-613853-404R50-6100-2514-4210-40613853RR5000-DEFAULT

Authorized Signature

LENDALL, JOSEPH, Procurement Officer

Digitally signed by Joseph Lendall  
 DN: cn=Joseph Lendall, o=Smithsonian Institution,  
 email=jlendall@si.edu, c=US  
 Date: 2015.11.18 09:45:22 -0500

**Purchase Order****Issuing Office**

Smithsonian Institution  
Smithsonian Observatory  
60 Garden Street  
Cambridge MA 02138  
United States

**CHANGE ORDER****Dispatch via Print**

Purchase Order	Revision	Date	Page
15-PO-400-0000316889	2 - 11/01/2016	01/09/2015	1 of 3
Payment Terms	Freight Terms	Ship Via	
Net 30	FOB Destination	See Below	
Buyer	Phone	Currency	
LENDALL, JOSEPH	617/495-7401	USD	

Ship To: Smithsonian Observatory  
REF PO: 15-PO-400-0000316889  
60 Garden Street  
Cambridge MA 02138  
United States

Bill To: Smithsonian Observatory  
60 Garden Street  
Attn: Accounts Payable, M/S-26  
Cambridge MA 02138  
United States

Vendor: 0000042987  
David A. Arnold  
94 Pierce Rd  
Watertown MA 02472

Tax Exempt? Y	Tax Exempt ID: 53-0208027	Contract # (IF ANY)					
Ln-Sch	Item/Description	Qty	UOM	PO Price	Ext Amt	Due Date	

1 - 1	Non-personal, scientific consulting services	1.00	LOT	45,000.00	45,000.00	09/30/2017
-------	--	------	-----	-----------	-----------	------------

Line Total 45,000.00

Change Order #2 is issued to extend the period of performance, add hours and add \$15,000.00 in funding for continuation of services. The Purchase Order is changed, as follows:

\*Period of Performance: October 1, 2014 through September 30, 2017 or until funding limit is reached.

**PRICE AND PAYMENTS**

Contractor's services shall be billed at the rate of \$50 per hour for up to 720 hours. An additional amount of \$9,000.00 is estimated for travel for a total NOT-TO-EXCEED amount of \$45,000.00."

ALL OTHER TERMS AND CONDITIONS REMAIN THE SAME.

ACCEPTANCE: The Contractor hereby accepts the offer represented by the numbered Change Order subject to all terms and conditions set forth herein.

David A. Arnold  
Contractor (signature)

Nov. 15, 2016  
Date

Change Order #1 is issued to extend the period of performance, add hours and add \$15,000.00 in funding for continuation of services. The Purchase Order is changed, as follows:

\*Period of Performance: October 1, 2014 through September 30, 2016 or until funding limit is reached.

**PRICE AND PAYMENTS**

Contractor's services shall be billed at the rate of \$50 per hour for up to 480 hours. An additional amount of \$6,000.00 is estimated for travel for a total NOT-TO-EXCEED amount of \$30,000.00."

ALL OTHER TERMS AND CONDITIONS REMAIN THE SAME.

Contractor shall provide non-personal, technical services to the Smithsonian Astrophysical Observatory to analyze retroreflector configurations and options for satellite missions. The work shall be accomplished in accordance with Attachment (B) Statement of Work.

Period of Performance: October 1, 2014 through September 30, 2015 or until funding limit is reached.

**PRICE AND PAYMENTS**

Contractor's services shall be billed at the rate of \$50 per hour for up to 240 hours. An additional

803-0000-613853-404R50-6100-2514-4210-40813853RR5000-DEFAULT

Authorized Signature

LENDALL, JOSEPH, Procurement Officer

Digitally signed by Joseph Lendall  
DN: cn=Joseph Lendall, o=Smithsonian Institution,  
ou=Smithsonian Astrophysical Observatory,  
email=jlendall@si.edu, c=US  
Date: 2016.11.01 15:54:10 -0400

**Purchase Order**

**Issuing Office**  
 Smithsonian Institution  
 Smithsonian Observatory  
 60 Garden Street  
 Cambridge MA 02138  
 United States

**Vendor:** 0000042987  
 David A. Arnold  
 94 Pierce Rd  
 Watertown MA 02472

**CHANGE ORDER**

Dispatch via Print

Purchase Order	Revision	Date	Page
15-PO-400-0000316869	3 - 11/03/2017	01/09/2015	1 of 3
Payment Terms	Freight Terms	Ship Via	
Net 30	FOB Destination	See Below	
Buyer	Phone	Currency	
LENDALL, JOSEPH	617/495-7401	USD	

**Ship To:** Smithsonian Observatory  
 REF PO: 15-PO-400-0000316869  
 60 Garden Street  
 Cambridge MA 02138  
 United States

**Bill To:** Smithsonian Observatory  
 60 Garden Street  
 Attn: Accounts Payable, M/S-26  
 Cambridge MA 02138  
 United States

Tax Exempt?Y	Tax Exempt ID:53-0208027	Contract # (IF ANY)					
Ln-Sch	Item/Description	Mfg ID	Qty	UOM	PO Price	Ext Amt	Due Date
1 - 1	Non-personal, scientific consulting services		1.00	LOT	48,000.00	48,000.00	11/30/2017
<b>Line Total</b>						<u>48,000.00</u>	

Change Order #3 is issued to extend the period of performance, add hours and add \$3,000.00 in funding for continuation of services. The Purchase Order is changed, as follows:

"Period of Performance: October 1, 2014 through November 30, 2017 or until funding limit is reached.

**PRICE AND PAYMENTS**

Contractor's services shall be billed at the rate of \$50 per hour for up to 780 hours. An additional amount of \$9,000.00 is estimated for travel for a total NOT-TO-EXCEED amount of \$48,000.00."

ALL OTHER TERMS AND CONDITIONS REMAIN THE SAME.

ACCEPTANCE: The Contractor hereby accepts the offer represented by the numbered Change Order subject to all terms and conditions set forth herein.

David A. Arnold  
 Contractor (signature)

NOV. 3, 2017  
 Date

Change Order #2 is issued to extend the period of performance, add hours and add \$15,000.00 in funding for continuation of services. The Purchase Order is changed, as follows:

"Period of Performance: October 1, 2014 through September 30, 2017 or until funding limit is reached.

**PRICE AND PAYMENTS**

Contractor's services shall be billed at the rate of \$50 per hour for up to 720 hours. An additional amount of \$9,000.00 is estimated for travel for a total NOT-TO-EXCEED amount of \$45,000.00."

ALL OTHER TERMS AND CONDITIONS REMAIN THE SAME.

Change Order #1 is issued to extend the period of performance, add hours and add \$15,000.00 in funding for continuation of services. The Purchase Order is changed, as follows:

"Period of Performance: October 1, 2014 through September 30, 2016 or until funding limit is reached.

**PRICE AND PAYMENTS**

Contractor's services shall be billed at the rate of \$50 per hour for up to 480 hours. An additional amount of \$6,000.00 is estimated for travel for a total NOT-TO-EXCEED amount of \$30,000.00."

803-0000-613853-404R50-6100-2514-4210-40613853RR5000-DEFAULT

Authorized Signature

LENDALL, JOSEPH, Procurement Officer

Joseph Lendall  
 2017.11.03 14:22:29 -04'00'

**Purchase Order**

**Issuing Office**  
 Smithsonian Institution  
 Smithsonian Observatory  
 60 Garden Street  
 Cambridge MA 02138  
 United States

**CHANGE ORDER**

Dispatch via Print

Purchase Order	Revision	Date	Page
15-PO-400-0000316869	4 - 11/24/2017	01/09/2015	1 of 3
Payment Terms	Freight Terms	Ship Via	
Net 30	FOB Destination	See Below	
Buyer	Phone	Currency	
LENDALL, JOSEPH	617/495-7401	USD	

Vendor: 0000042887  
 David A. Arnold  
 84 Pierce Rd  
 Watertown MA 02472

Ship To: Smithsonian Observatory  
 REF PO: 15-PO-400-0000316869  
 60 Garden Street  
 Cambridge MA 02138  
 United States

Bill To: Smithsonian Observatory  
 60 Garden Street  
 Attn: Accounts Payable, M/S-26  
 Cambridge MA 02138  
 United States

Ln	Sch	Item/Description	Qty	UOM	PO Price	Ext Amt	Due Date
----	-----	------------------	-----	-----	----------	---------	----------

1 - 1		Non-personal, scientific consulting services	1.00	LOT	48,695.29	49,695.29	11/30/2017
-------	--	--	------	-----	-----------	-----------	------------

Line Total 49,695.29

Change Order #4 is issued to add \$1695.29 in funding for continuation of services; to cover final invoice. The Purchase Order is changed, as follows:

\*Period of Performance: October 1, 2014 through November 30, 2017 or until funding limit is reached.

**PRICE AND PAYMENTS**

Contractor's services shall be billed at the rate of \$50 per hour for up to 780 hours. An additional amount of \$10,695.29 is estimated for travel for a total NOT-TO-EXCEED amount of \$49,695.29."

ALL OTHER TERMS AND CONDITIONS REMAIN THE SAME.

ACCEPTANCE: The Contractor hereby accepts the offer represented by the numbered Change Order subject to all terms and conditions set forth herein.

David A. Arnold  
 Contractor (signature)

NOV. 24, 2017  
 Date

Change Order #3 is issued to extend the period of performance, add hours and add \$3,000.00 in funding for continuation of services. The Purchase Order is changed, as follows:

\*Period of Performance: October 1, 2014 through November 30, 2017 or until funding limit is reached.

**PRICE AND PAYMENTS**

Contractor's services shall be billed at the rate of \$50 per hour for up to 780 hours. An additional amount of \$9,000.00 is estimated for travel for a total NOT-TO-EXCEED amount of \$48,000.00."

ALL OTHER TERMS AND CONDITIONS REMAIN THE SAME.

Change Order #2 is issued to extend the period of performance, add hours and add \$15,000.00 in funding for continuation of services. The Purchase Order is changed, as follows:

\*Period of Performance: October 1, 2014 through September 30, 2017 or until funding limit is reached.

**PRICE AND PAYMENTS**

Contractor's services shall be billed at the rate of \$50 per hour for up to 720 hours. An additional amount of \$9,000.00 is estimated for travel for a total NOT-TO-EXCEED amount of \$45,000.00."

803-0000-613853-404R50-6100-2514-4210-40813853RR5000-DEFAULT  
 Authorized Signature Joseph Lendall Joseph Lendall  
 LENDALL, JOSEPH, Procurement Officer 2017.11.24 11:25:04 -05'00'

## Exhibit B

**From:** Mike Pearlman <mpearlman@cfa.harvard.edu>  
**Date:** Monday, March 21, 2016 at 12:22 PM  
**To:** David Arnold <david-arnold@earthlink.net>  
**Cc:** ErricosUmbc Pavlis <epavlis@umbc.edu>  
**Subject:** Re: FW: effective cross sections of retro reflectores at 1064nm

David,

No, this is not the project.

Erricos Pavlis is working on a variation on Lares. This could be a very important missions for us. He needs some help right away. The initial work would be done under my support for you.

Are you available?

Please call him and speak with him. If necessary we can get on a 3-way telecon. We need to move out quickly.

Mike

**From:** Mike Pearlman <mpearlman@cfa.harvard.edu>  
**Date:** Monday, March 21, 2016 at 3:59 PM  
**To:** David Arnold <david-arnold2006@earthlink.net>  
**Subject:** Re: Dave Arnold availability

Dave,

You can include this under SAO funding at least initially.

Mike

## **Exhibit C**

**<https://www.eeoc.gov/contract-monitors-duties-and-responsibilities>**

### **4. Duties of Contract Monitor**

The Contract Monitor acts on behalf of the Contracting Officer by performing the following specific duties:

- a. Reviews and approves reports and all materials provided by the Contractor as called for by the contract. Notifies the Contracting Officer and Supervisor if reports or other items submitted are to be rejected and states the basis for rejection.
- b. Completes and forwards timely progress reports, and final reports to the Contracting Officer.
- c. Certifies the Contractor's invoices for payment, including any credit due the Government. This includes the authority to request the Contractor to make corrections and/or submit new invoices when clerical or other errors are detected.

[Note: The Prompt Payment Act requires notification to the Contractor within 7 days of receipt of an invoice containing errors, and suitable documentation of such notification.]

- d. Keeps detailed records of the Contractor's performance, and if it is not satisfactory or if problems are anticipated, notifies the Contracting Officer and supervisor, in writing, as to the cause and recommends a course of action from a technical standpoint. Immediate notification is essential to assure that the Contracting Officer takes timely and appropriate action to protect the Government's rights under the contract.
- e. Provides copies of all correspondence between the Contract Monitor and the Contractor relating to contract issues to the Contracting Officer and supervisor.
- f. Prepares memoranda for the record covering all meetings/discussions between the Contract Monitor and the Contractor and forwards copies to the Contracting Officer and supervisor. It is critically important to keep the Contracting Officer informed of the context of all communications with the Contractor to prevent misunderstandings or situations that could affect the contract terms or conditions and become the basis of future claims against the Government.

- g. Advises the Contractor that in the event the Contractor desires to propose a change, he or she should submit the request in writing to the Contract Monitor and specifically identify the effect that the proposed change(s) will have on the terms of the contract (technically and/or monetarily). The Contract Monitor will review the proposed change(s) and if he or she agrees that the changes are necessary to achieve the desired outcome, he or she will recommend to the Contracting Officer and supervisor, in writing, that the proposed change(s) should be incorporated into the contract.
- h. Assures that changes in work under the contract are not implemented before written authorization or a contract modification is issued by the Contracting Officer. Costs for work performed may not be allowed if not authorized under the contract. No change or commitment should be directed without prior written authorization by the Contracting Officer.
- i. Recommends, in writing, to the Contracting Officer through the supervisor any changes in the contract required by the Government with detailed justification for the proposed change.
- j. Makes site visits, when appropriate, to the Contractor's facility and checks contractor performance to include:

  - 1. (1) Actual performance versus scheduled and reported performance. The Contracting Officer and supervisor should be informed of any adverse conditions noted;
  - 2. (2) Changes in technical performance which may affect the Contractor's financial status, create personnel or labor difficulties, overextend facilities, etc.;
  - 3. (3) Verification that the employees charged to the contract are actually performing work under the contract;
  - 4. (4) Verification that all Government Furnished Property (GFP) is being used strictly for the contract and that proper safeguards are in place to protect all GFP from theft or damage.
- k. Ensures timely notification by the Contractor of any anticipated overrun or underrun of the estimated cost under cost-reimbursement contracts.
- l. Advises the Contracting Officer through the supervisor on the status of the following at the completion of the contract:

  - 1. (1) Whether all articles and services required to be furnished or performed under the contract have been technically accepted;
  - 2. (2) The disposition of all Government Furnished Property or materials;
  - 3. (3) Any other outstanding technical issues.
- m. Prepares requests to (i) fund each contract phase, (ii) obtain additional funding, if necessary, for each phase, and (iii) exercise the option contained in most expert services contract to extend the period of performance to ensure successful completion of the expert's services. Before extending the

period of performance, the Contract Monitor should confer with the Contractor to determine whether the Contractor intends to exercise an option to increase his or her hourly rates. If so, the Contract Monitor should request additional funding to cover future rate increases. This request shall include a document certifying that funds are available and shall be submitted at least 90 days before the period of performance expires.

n. Although the Contracting Officer is ultimately responsible for the following, the Contract Monitor shall also provide technical support, when requested, in the following areas:

1. (1) Approving premium overtime;
2. (2) Debriefing unsuccessful offerors;
3. (3) Resolving post-award disputes/protests;
4. (4) Resolving terminations and claims;
5. (5) Negotiating/issuing time extensions;
6. (6) Approving key personnel changes;
7. (7) Issuing suspensions/stop work orders;
8. (8) Assessing/approving liquidated damages;
9. (9) Negotiating/issuing equitable adjustments;
- 10.(10) Documenting/issuing Contracting Officer's final decisions;
- 11.(11) Preparing appeal files;
- 12.(12) Determining whether a conflict of interest exists; and
- 13.(13) Preparing data/responses for audit/Congressional inquiries.

## Exhibit D

---

**Subject:** LARES-2 Support

**Date:** Tuesday, November 6, 2018 at 11:56:56 PM Eastern Standard Time

**From:** Merkowitz, Stephen M. (GSFC-61A0)

**To:** David Arnold

Dave,

Sorry for the delayed response; I'm on travel to the ILRS workshop. Erricos did a great job giving your presentation and I found it very interesting and relevant to other work we are doing with retros. I really appreciate the work you've done both for the ILRS and our lunar retroreflector efforts. I've learned a lot from you on the lunar development and the analysis you've performed has really helped define the requirements on the lunar reflector.

With respect to your request for NASA supporting your participation in the LARES-2 project, as I mentioned in a previous email, I am not aware of any agreement between NASA and ASI to cooperate on the design or implementation of LARES-2. NASA support of the ILRS does not include any direct support of foreign agency mission design work. NASA does support analysis of existing designs for the purpose of preparing for tracking, but any effort beyond this limited scope should be supported by the mission's sponsoring agency and/or cooperating partners. This is not a policy choice, but rather a legal restriction set by Congress in the NASA appropriations and the Space Act.

I am also not familiar with the terms of your contract with SAO and I am prohibited from getting involved in another organization's contract management, even if it is using NASA funding. NASA is very strict about this point so I cannot mediate or take any actions with respect to your contract with SAO.

I understand that this response is not what you were hoping for, but I need to be careful to follow the rules and laws that govern my position. I really hope that we are able to find a way for you to stay engaged in the ILRS. Your contributions are widely recognized! Both Erricos and Mike have expressed to me that there is a continuing need for your expertise. With so many new missions applying for SLR tracking, I'm sure there will be a lot of need to analyze the retroreflector configurations in support of NASA and ILRS objectives.

Sincerely,

Stephen

## Exhibit E

**From:** Mike Pearlman <mpearlman@cfa.harvard.edu>

**Date:** Tuesday, October 23, 2018 at 11:50 AM

**To:** David Arnold <david-arnold2006@earthlink.net>

**Subject:** Re: International cooperation

David,

I understand that you are very unhappy and this last year has put a lot of pressure on you.

We place great value your work. Your contribution to the space geodesy program has been very significant. Your patience with the Italians has been much appreciated.

I had thought that you and I had a good working relationship. I included money in my grant to keep you with us. I have trusted your judgement on tasks and time. My funding was limited of course.

I agree that the last year was very trying. LARES 2 was an Italian satellite, but recognizing the important of the mission to space geodesy, we agreed that you could spend contract money on this mission. I know this brought on lots of aggravation for you.

I am hoping we can resolve the situation. Can we get together and discuss the situation? The next contract year is about to start; we can discuss the terms.

If you decide that you cannot work with me, I would respect your decision. Maybe some other arrangement can be made elsewhere. Meanwhile I hope we can work something out.

Let me know.

Mike

## **Exhibit F**

(Dr. Pearlman's response inserted in original email)

**From:** Mike Pearlman <mpearlman@cfa.harvard.edu>

**Date:** Friday, October 19, 2018 at 7:51 AM

**To:** David Arnold <david-arnold2006@earthlink.net>

**Subject:** Re: The LARES-2 project

On Fri, Oct 19, 2018 at 7:36 AM David Arnold <david-arnold2006@earthlink.net> wrote:

Hi Mike,

There is an old saying. "You can't get something for nothing." With me you can get something for nothing. The reason is that I do what needs to be done whether or not I get paid.

We appreciate that.

There is another saying. "A day's work for a day's pay". I did not get a day's pay for a day's work on the LARES-2 project.

Yes - but think of your contribution to science.

People deserve credit and appreciation for the work they do even if they get paid a fair amount. Ignazio tried to hide the fact that the person who really did the thermal-optical design of the LARES-2 satellite was me, not the Italian team.

The rest of us appreciate your contribution very much.

One of the motivations for working is having a good relationship with coworkers. My relationship with the people running the LARES-2 program has been destroyed.

Hopefully not with the rest of the community.

The people running the LARES-2 project do not seem to value these basic principles. This is why I am refusing to work for them in the future.

I understand

I feel a lot of resentment because they took advantage of me. The motivation to work has been destroyed.

After a little rest hopefully you will feel better.

My understanding is that the LARES-2 project is funded by ESA. However, the LARES-2 project will benefit NASA since it can be used for all the earth physics studies. Is NASA willing to contribute to the work I did on LARES-2 that I never got paid for? I would like to feel that there is someone who appreciates all the work I did on this project.

Lets work on the compensation for the loss on the trip to Canberra.

Mike

## **Exhibit G**

**From:** Mike Pearlman <mpearlman@cfa.harvard.edu>

**Date:** Monday, November 20, 2017 at 12:02 PM

**To:** David Arnold <david-arnold@earthlink.net>

**Subject:** Re: Present subcontract - My mistake

Dave,

You have some good guys working with you.

As far as funding goes, I had to fight hard to get what we got.

Have a nice Thanksgivings.

Mike

On Mon, Nov 20, 2017 at 11:36 AM, David Arnold <david-arnold@earthlink.net> wrote:

Mike,

The workload over the past year has been beyond available funding. The goal of one millimeter accuracy has raised issues people were not concerned about in the past. Reinhart has been helping a lot with these issues. Ludwig who is now retired has been critical to many aspects of these issues.

Best,

David Arnold

## Exhibit H

**From:** Mike Pearlman <mpearlman@cfa.harvard.edu>  
**Date:** Thursday, November 30, 2017 at 10:37 AM  
**To:** David Arnold <david-arnold@earthlink.net>  
**Cc:** "Hodges, Muriel" <mhodges@cfa.harvard.edu>, "<cmcneil@cfa.harvard.edu>" <cmcneil@cfa.harvard.edu>  
**Subject:** Re: Estimate of cost

David,

All we need is an annual cost breakdown for each if the next 3 years starting December.

Labor (12k/yr), Travel (3 k/yr)

Put it on your letterhead.

I need it ASAP.

Mike

On Thu, Nov 30, 2017 at 9:42 AM, David Arnold <david-arnold@earthlink.net>wrote:

Mike,

The work load from the summer of 2016 to the present has been such that I work a large part of every day. I get paid for 5 hours a week but end up working more like 5 hours per day 7 days a week. The primary reason has been the design of LARES-2. The design is fundamentally different in order to meet the current goal of one millimeter accuracy. That work should start decreasing soon.

The accuracy goal of one millimeter has raised a lot of new issues regarding the way the stations calibrate their systems, the lack of control over signal strength, the unmodeled properties of the CSPAD, and most recently the method of computing normal points. In my opinion, the present method of forming normal points is fundamentally wrong. It does not take into account the very asymmetric nature of the satellite response function and the response function of the receiver and transmitted pulse. Because of the asymmetry of the response functions the CoM values vary with the RMS of the data, the background noise, and errors in the fitting process. The analysts are seeing inconsistencies of a few millimeters in the CoM values.

In my opinion, the solution to the normal point problem is to use the correlation method which I presented at the workshop in Riga. This method recognizes that the satellite is not a point target. The range correction is a very asymmetric pulse shape (histogram) not a constant CoM value. The correlation method eliminates the dependence on background noise, RMS of the data, and error in the fitting process. Implementing the correlation method is a fundamental change that is going to take a lot of work. I expect to be working primarily with Reinhart and Erricos.



## Exhibit 1



# Global Geodetic Observing System of the International Association of Geodesy

September 18, 2017

TO:

President Roberto Buatois, Agencia Nacional de Promoción Científica y Tecnológica

Dr. Giovanni Benito, Agencia Española de Investigación Científica

CC:

Prof. Ignasi Ribera

Prof. Anthony Caputo

URGENT MATTER - PRIORITY

Dear President Buatois and Dr. Benito,

The International Geodetic Service (IGS) of the Global Geodetic Observing System (GGOS) is a service of the International Association of Geodesy (IAGG) and the International Union of Pure and Applied Physics (IUPAP). We are the observing arm of the International Geodetic Service (IGS) and the International Geodetic Service (IGS) is the observing arm of the International Geodetic Service (IGS).

The IGS is a service of the International Geodetic Service (IGS) and the International Geodetic Service (IGS) is the observing arm of the International Geodetic Service (IGS). The IGS is a service of the International Geodetic Service (IGS) and the International Geodetic Service (IGS) is the observing arm of the International Geodetic Service (IGS). The IGS is a service of the International Geodetic Service (IGS) and the International Geodetic Service (IGS) is the observing arm of the International Geodetic Service (IGS).

The IGS is a service of the International Geodetic Service (IGS) and the International Geodetic Service (IGS) is the observing arm of the International Geodetic Service (IGS). The IGS is a service of the International Geodetic Service (IGS) and the International Geodetic Service (IGS) is the observing arm of the International Geodetic Service (IGS). The IGS is a service of the International Geodetic Service (IGS) and the International Geodetic Service (IGS) is the observing arm of the International Geodetic Service (IGS).

Very truly yours,

Prof. Dr. Dr.

Prof. Dr. Dr.

